LEVITRONIX®

Ultrapure Fluid Handling
Integrated Pump System Series

BPS-i30

1.5 bar	(22 psi)
7.4 liters/min	(2 gallons/min)

No Bearings. No Seals. No Contamination!

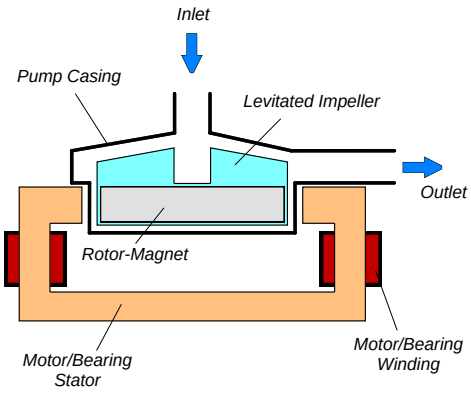


Figure 1: *Schematic of the main elements of the MagLev centrifugal pump*

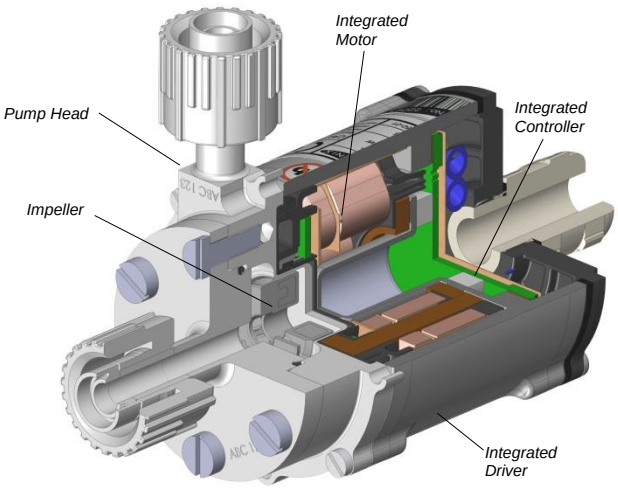


Figure 2: *Integrated MagLev pump driver with pump head*

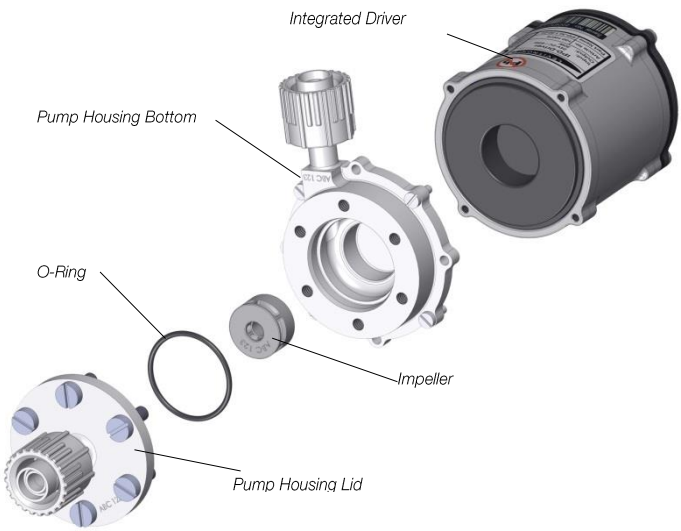


Figure 3: *Disassembled pump head*

INTRODUCTION

The *BPS-i30* pump system is a revolutionary centrifugal pump that has no bearings to wear out or seals to break down and fail. Based on the principles of magnetic levitation, the pump impeller is suspended, contact-free, inside a sealed casing and is driven by the magnetic field of the motor (*Figure 1*).

The impeller and casing are both fabricated from chemical-resistant high purity fluorocarbon resins. Together with the rotor magnet they make up the pump head.

The controller and the motor are integrated into the driver housing (see *Figure 2*), hence cabling effort is reduced. Fluid flow rate and pressure are precisely controlled by electronically regulating the impeller speed without pulsation.

SYSTEM BENEFITS

- Extremely low particle generation due to the absence of mechanically contacting parts.
- Increased equipment uptime.
- Lower maintenance costs by eliminating valves, bearings, rotating seals and costly rebuilds.
- Very low integration costs as no external controller is needed for speed or closed loop control.
- Reduced risk of contamination due to the self-contained design with magnetic bearings.
- Very gentle to sensitive fluids due to low-shear design.
- No narrow gaps and fissures where particles or microorganisms could be entrapped.
- Smooth, continuous flow without pressure pulsation.
- Electronic speed control.
- Compact design compared to pneumatic and mag-drive pumps.
- Proven technology in medical and semiconductor industry (MTBF > 50 years).

APPLICATIONS

- Semiconductor wet processing.
- Flip chip and advanced packaging.
- Solar cell production.
- Flat panel display manufacturing.
- Hard-disk fabrication.
- Printer ink handling.
- Pharmaceutical production.
- Plating.
- Circulation in flow batteries.

SYSTEM CONFIGURATION – “STAND-ALONE”

Figure 7 and *Figure 11* illustrate a “Plug and Play” stand-alone system with integrated user panel and buttons to set the speed manually. The driver also contains a PLC interface for remote speed control by analog and digital signals.

Various accessories are available like a desktop power supply with relevant power cable and signal cables to connect to the PLC.

SYSTEM CONFIGURATION – “EASYCONNECT”

The “EasyConnect” models (see *Figure 8* and *Figure 13*) with according cable accessories are designed to realize various interface configurations with minimal setup effort.

Two Fieldbus connectors (IN and OUT) allow to setup arrays of multiple pumps. Therefore serial pumping configurations as shown in *Figure 9* can be realized. The PLC interface allows not only remote control by analog/digital signals but also connections of external sensors hence enabling for example a precise flow or pressure control (see notes below).

For enhanced chemical protection of the motor and cable connectors, protective connector covers (see *Figure 18*) are available.

SYSTEM CONFIGURATION – “OEM”

The “OEM” models are designed for a compact integration with one integrated driver cable containing all available interface signals (see *Figure 10* and *Figure 15*). Basically all configurations of the “EasyConnect” models are possible allowing the users with integration capabilities to adapt the cable to their needs.

PROCESS CONTROL WITH FEEDBACK SENSORS

Together with an external sensor process parameters like flow or pressure can be controlled or monitored as shown in *Figure 10*.

Precise ultrapure flow control systems can be realized with the *BPS-i30* pump system in combination with *LEVIFLOW®* flowmeters. *Levitronix®* provides either turnkey solutions for closed loop flow control or helps to design your own flow control system. Experience has been gained with fluids such as CMP slurries, surface-conditioning chemicals, plating solutions, ultrapure water and solvents.

The versatility of *Levitronix®* flow control systems goes far beyond the capabilities of simple flow controllers. In addition to the flow control function, the *Levitronix®* control firmware comes with several condition monitoring features to monitor the integrity of the fluid circuit. *Levitronix®* flow control systems can generate alarms for preventive filter exchange, no-flow conditions or line clogging. Dynamic Condition Trending (DCT) enables failure prediction and scheduling of preventive maintenance (*Figure 6*).

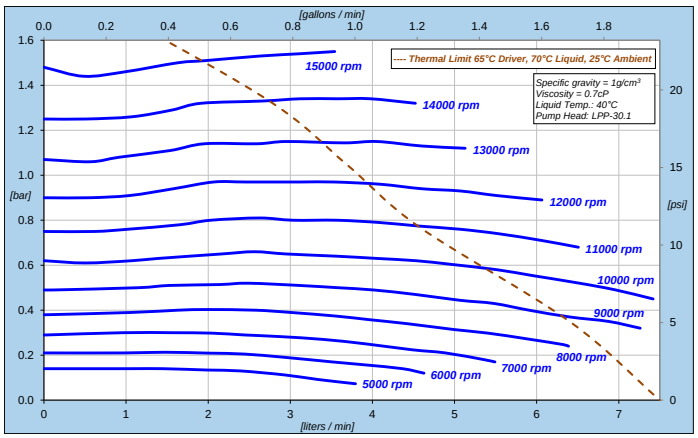


Figure 4: *Pressure/flow curves for aqueous liquids (similar to water)*

Figure 5: *Pump system models*

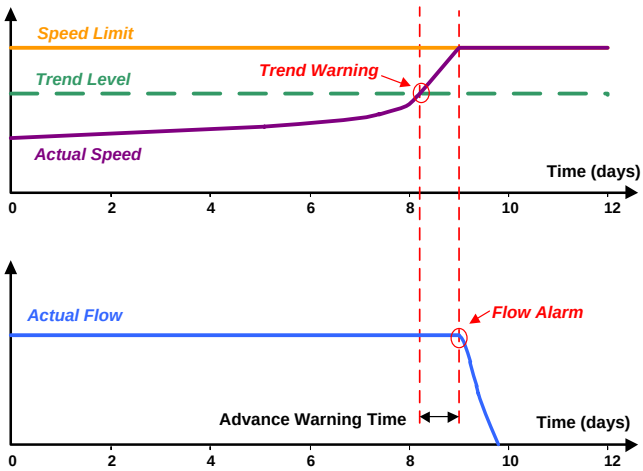


Figure 6: *Dynamic Condition Trending (DCT)*

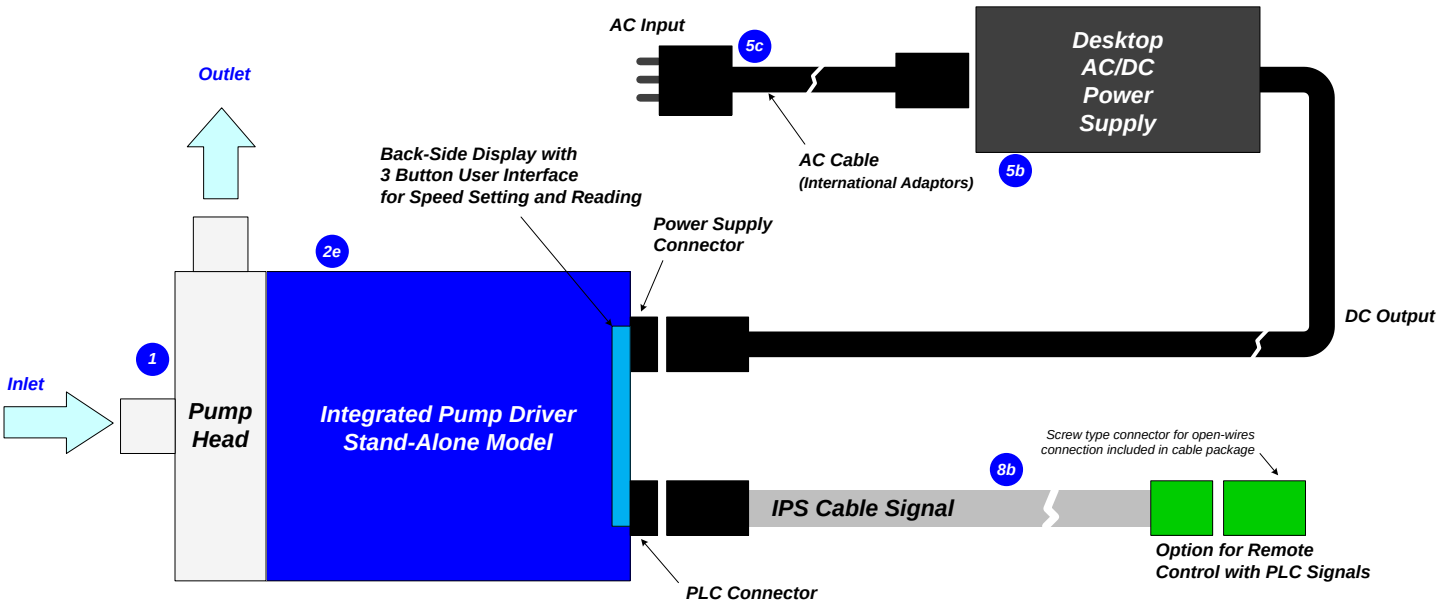


Figure 7: Standard "Stand-Alone" system configuration with main accessories
(See section "Order Information" for details to numbered components and other options)

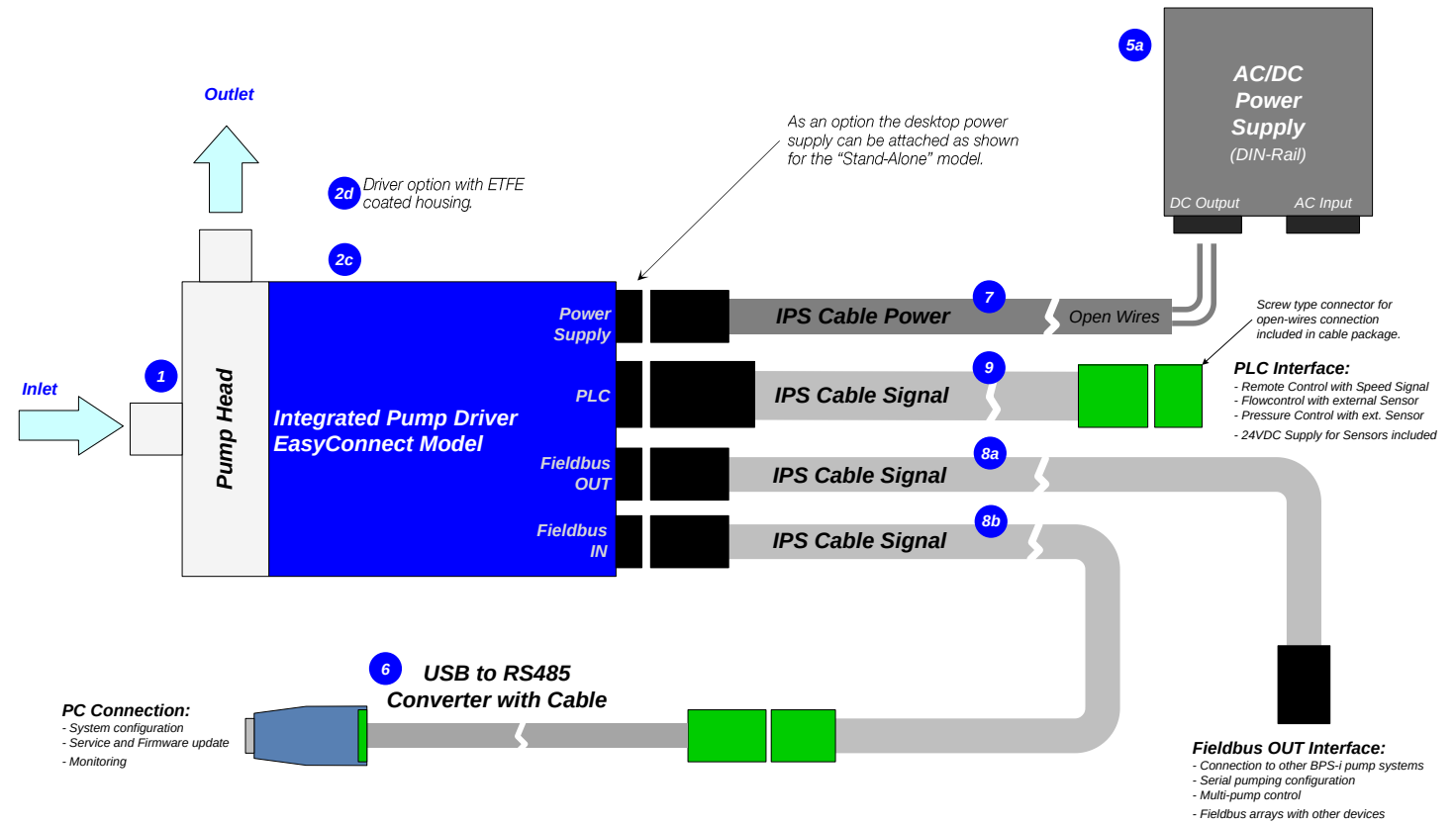


Figure 8: Standard "EasyConnect" system configuration with main accessories
(See section "Order Information" for details to numbered components and other options)

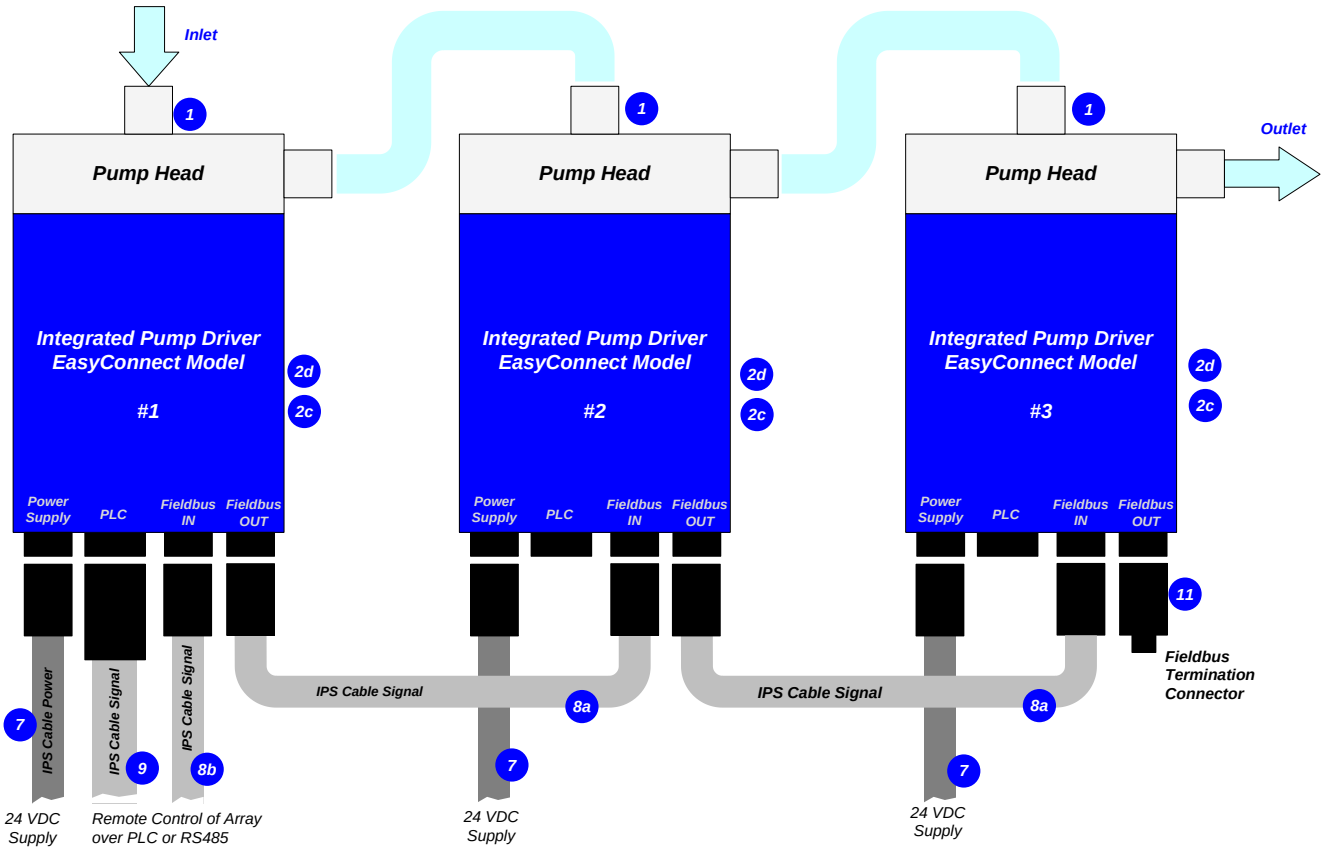


Figure 9: Serial pumping configuration with "EasyConnect" models
(See section "Order Information" for details to numbered components and other options)

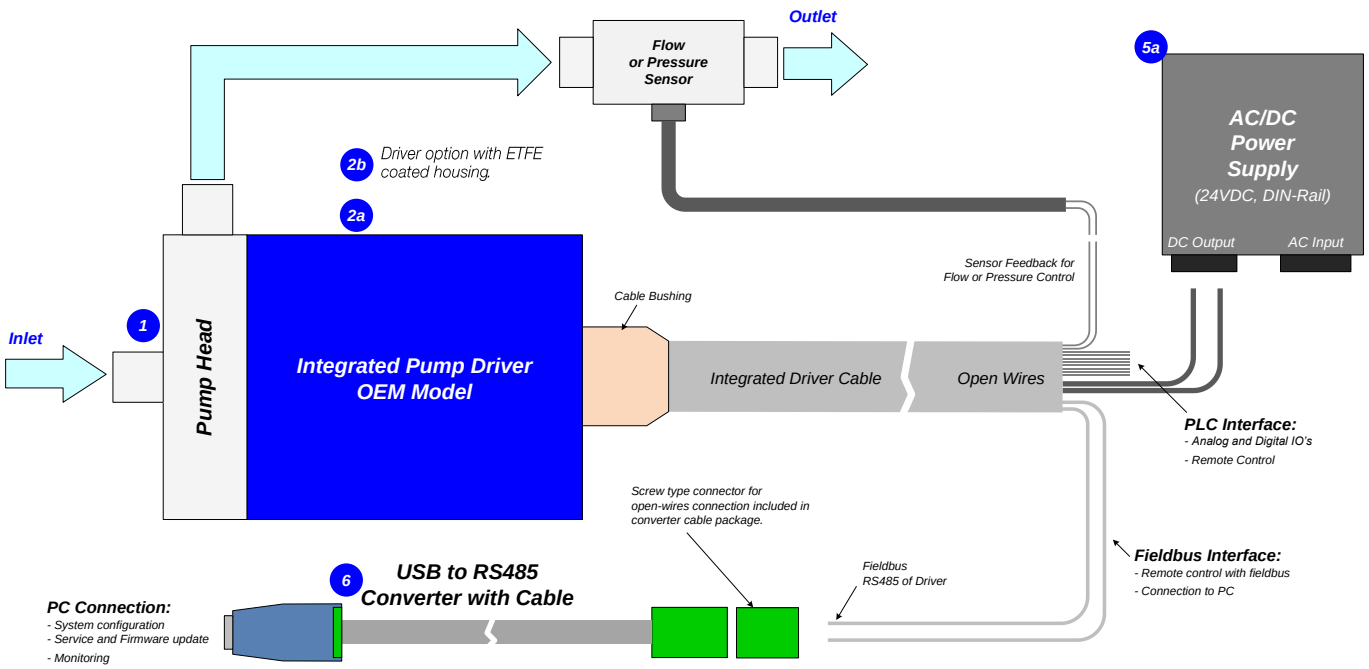
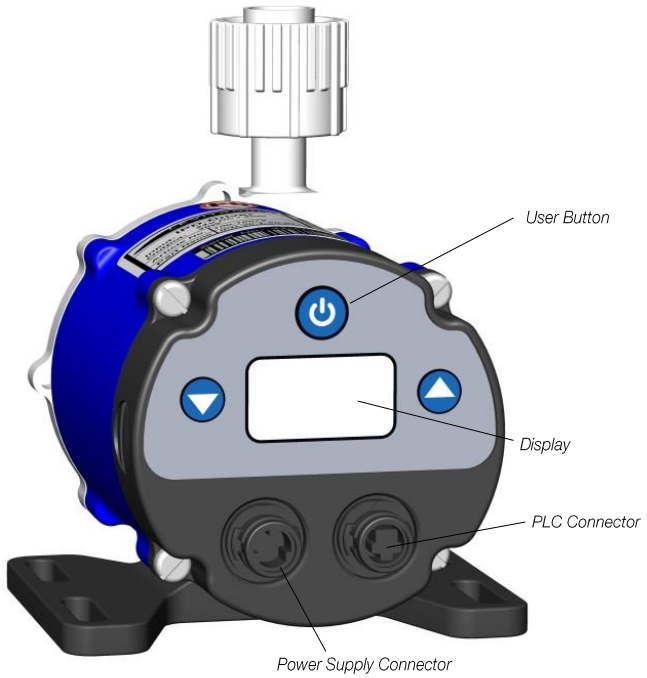


Figure 10: Standard "OEM" system configuration
(See section "Order Information" for details to numbered components and other options)



Interface	PIN Name	Description	Standard Designation	Hardware Specification
Power Supply	P+	+ 24 VDC	Supply	Voltage: 24 VDC Power: 35 W
	P-	Power Input Ground / Earth		
	NC	Not connected.	--	--
PLC 6	Ain	Analog Input (Current Input)	Remote Speed	Analog current input: 4 – 20 mA (450 Ohm shunt input, no galvanic isolation)
	Ain_GND	Analog In. GND	--	Reference for Ain
	Dout	Digital Output 1	Status	Open drain, max. 24V, 100mA Reference ground is GND
	GND	Analog Ground	--	Reference for Dout
	Din1	Digital Input 1	Enable (Reset)	Galvanic separation with optocoupler 2.2 kΩ input resistance, 5-24V for active input
	Din_COM	Com. Digi. Input	--	Reference for digital input.
Display and Buttons	--	Display	Speed and Status Display	
	--	Up/Down	Setting speed	--
	--	On/Off	Enable/Disable	--

Figure 11: Interface specifications of standard "Stand-Alone" model

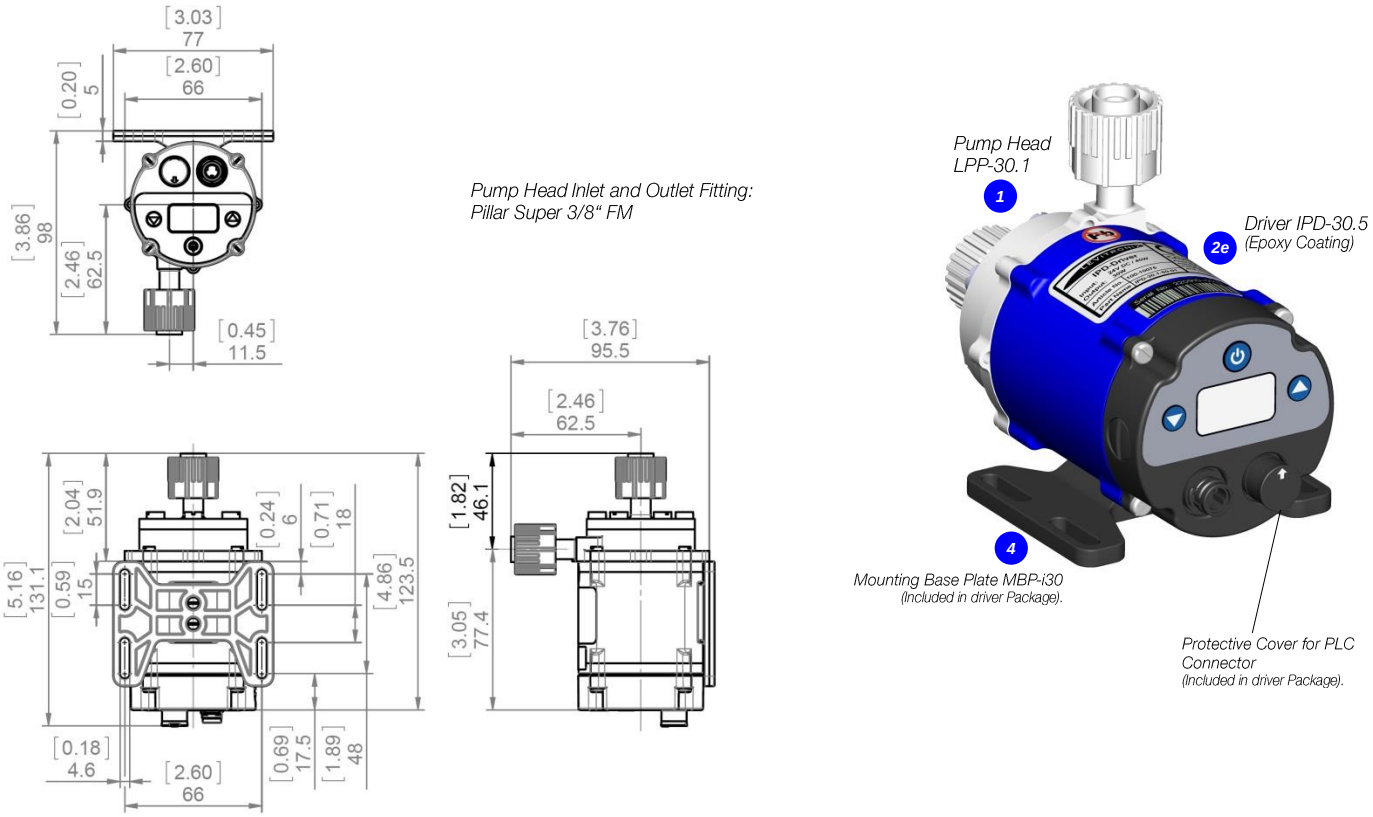
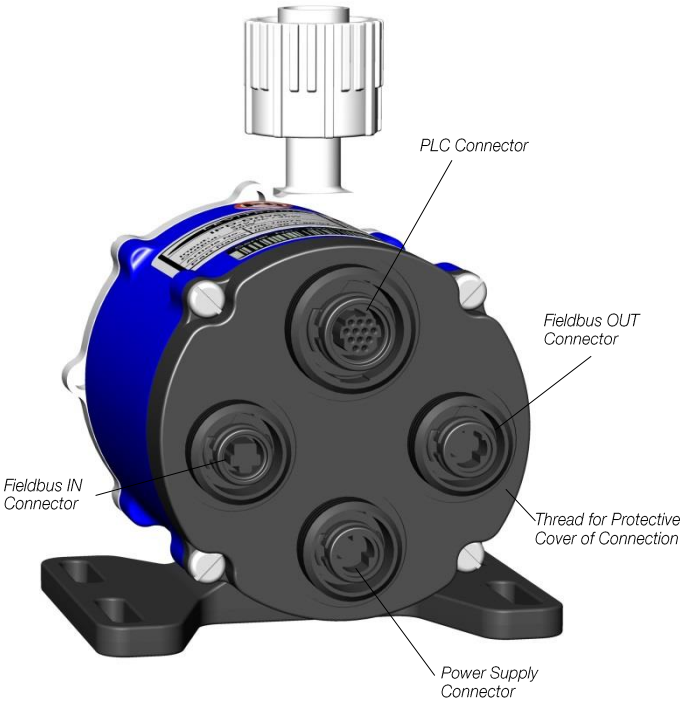


Figure 12: Basic dimensions and description of standard "Stand-Alone" model
(Driver IPD-30.5 with pump head LPP-30.1)



Connector	PIN Name	Description	Standard Designation	Hardware Specification
Power Supply	P+	+ 24 VDC	Supply	Voltage: 24 VDC Power: 35 W
	P-	Ground / Earth		
	NC	Not connected.	--	--
PLC 12	Dout1	Digital Output 1	Status	Open drain, max. 24V, 100mA Reference ground is GND
	Dout2	Digital Output 2	Error	
	Din1	Digital Input 1	Enable (Reset)	Galvanic separation with optocoupler
	Din2	Digital Input 2	Process Mode	2.2 kΩ input resistance, 5-24V for active input
	Din_COM	Com. Digi. Input	--	Reference for digital input.
	Ain1	Analog Input 1 (Current Input)	Actual Process Value	Analog current input: 4 – 20 mA (450 Ohm shunt input, no galvanic isolation)
	Ain2	Analog Input 2 (Voltage Input)	Reference Value	Analog voltage input: 0 – 10V (7.9 kOhm, no galvanic isolation)
	Ain_GND	Analog In. GND	--	Reference for Ain1 and Ain2
	Aout1	Analog Output (Voltage Output)	Actual Speed	0 – 10V (no galvanic isolation) GND is reference
	GND	Analog Ground	--	Reference for Aout1, Dout1, Dout2 and Pout
	Pout	Output 24 VDC	Supply output	For supply of external devices (e.g. sensors) (Current 200 mA together with Pout of Fieldbus OUT)
	NC	Not connected.	--	--
Fieldbus OUT	GND	Ground	--	Connected to AGND and reference for supply
	Pout	Output 24 VDC	Supply Output	For supply of external devices (user panels) (Current 200mA together with Pout of PLC 12)
	RS485+	RS485 +	Field Bus	Modbus protocol
	RS485-	RS485 -		
	Internal	Internal Bus	Do not connect	Internal bus needed to connect pumps for serial pumping.
	Internal	Internal Bus	Do not connect	
Fieldbus IN	GND	Ground	--	Connected to AGND and reference for supply
	NC	Not connected.	--	--
	RS485+	RS485 +	Field Bus	Modbus protocol
	RS485-	RS485 -		
	Internal	Internal Bus	Do not connect	Internal bus needed to connect pumps for serial pumping.
	Internal	Internal Bus	Do not connect	

Figure 13: Interface specifications of standard "EasyConnect" models

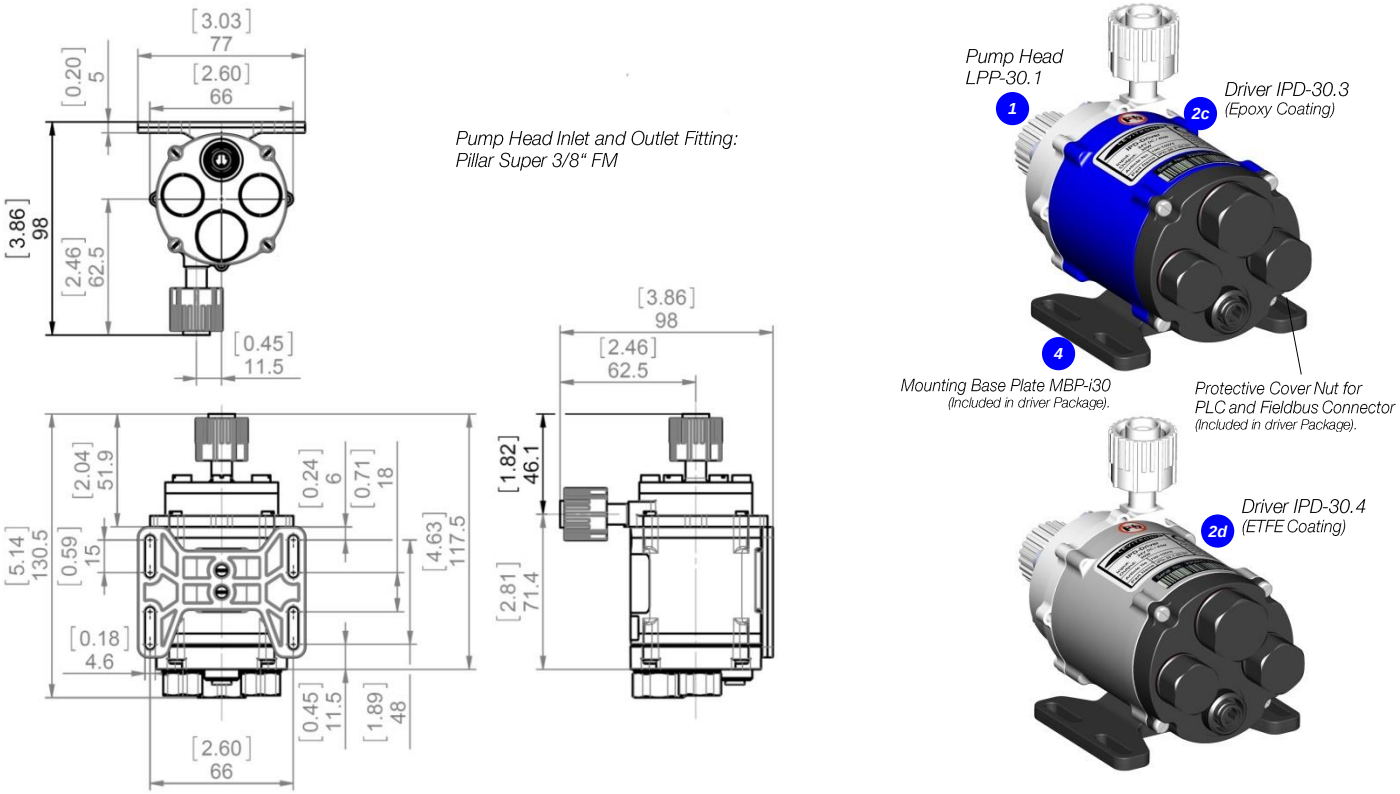
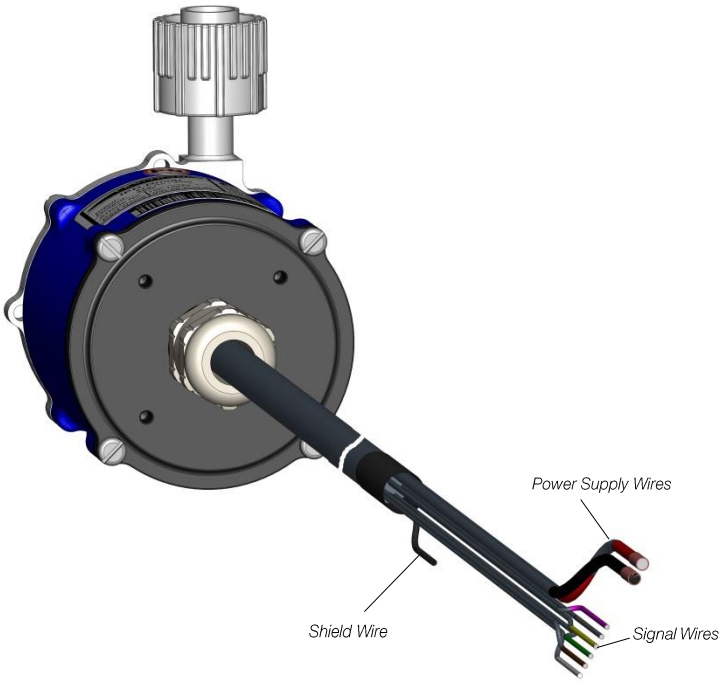


Figure 14: Basic dimensions and description of standard "EasyConnect" models
(Drivers IPD-30.3 and IPD-30.4 with pump head LPP-30.1)



Wire Name	Description	Standard Designation	Hardware Specification
P+	+ 24 VDC	Supply	Voltage: 24 VDC
P-	Power Input Ground / Earth		P- to be connected to earth
Ain1	Analog Input 1 (Current Input)	Actual Process Value	Analog current input: 4 – 20 mA (450 Ohm shunt input, no galvanic isolation)
Ain2	Analog Input 2 (Voltage Input)	Reference Value	Analog voltage input: 0 – 10V (7.9 kOhm, no galvanic isolation)
Ain_GND	Analog Input Ground	--	Reference for Ain1 and Ain2
Din1	Digital Input 1	Enable (Reset)	Galvanic separation with optocoupler
Din2	Digital Input 2	Process Mode	2.2 kΩ input resistance, 5-24V for active input
Din_COM	Common Digital Input	--	--
Aout1	Analog Output (Voltage Output)	Actual Speed	0 – 10V (no galvanic isolation) AGND is reference
Dout1	Digital Output 1	Status	Open drain, max. 24V, 100mA
Dout2	Digital Output 2	Error	Reference ground is AGND
GND	Analog Ground	--	Reference for Aout1, Dout1 and Dout2
RS485+	RS485 +	Field Bus	Modbus protocol
RS485-	RS485 -		
Internal	Internal Bus	Do not connect	For internal usage.
Internal	Internal Bus	Do not connect	For internal usage.
Shield	Shielding	Shielding	To be connected to earth (see wire No. 2, P-)

Figure 15: Interface specifications of standard "OEM" models
Note 1: Power supply wires are 1.5mm² and signal wires 0.14mm² Note 2: For more detailed description of interfaces consult user manual

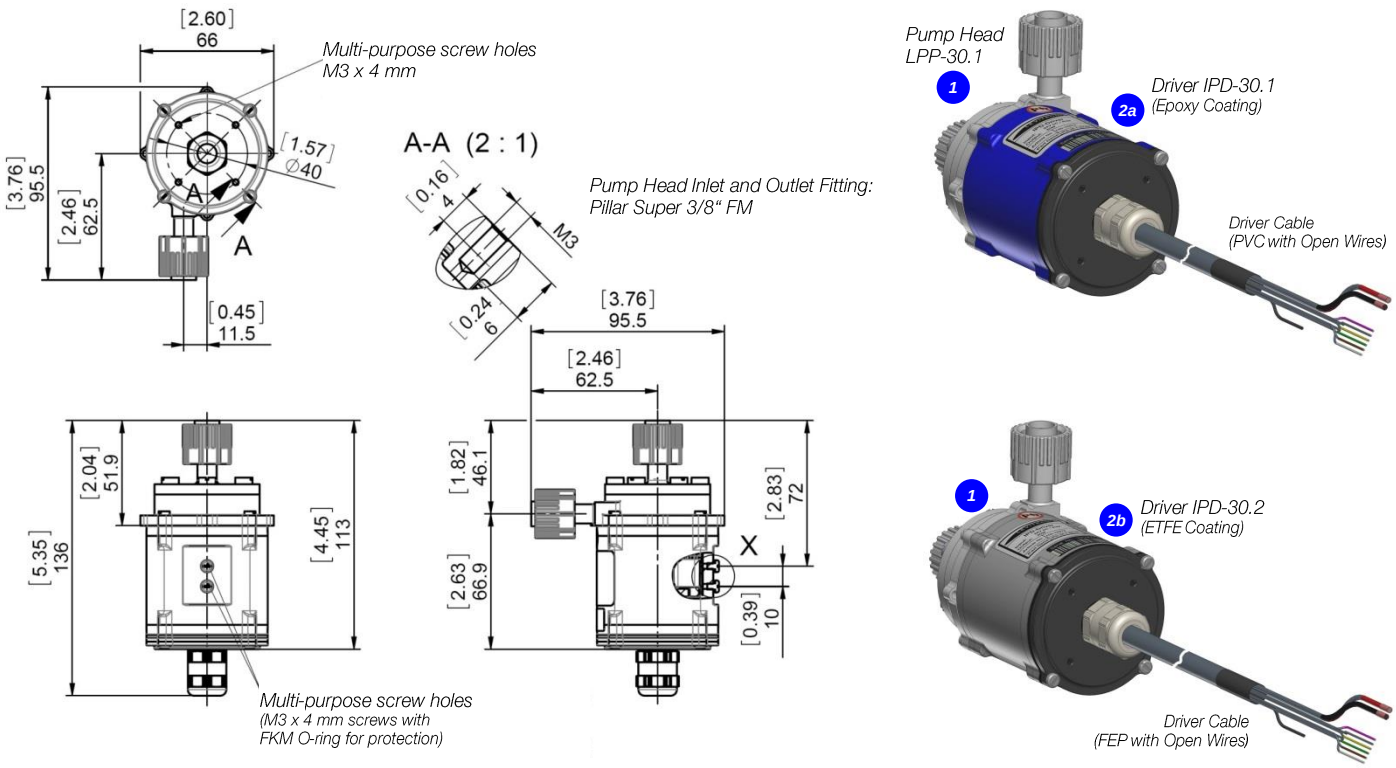


Figure 16: Basic dimensions and description of standard "OEM" models
(Drivers IPD-30.3 and IPD-30.4 with pump head LPP-30.1)

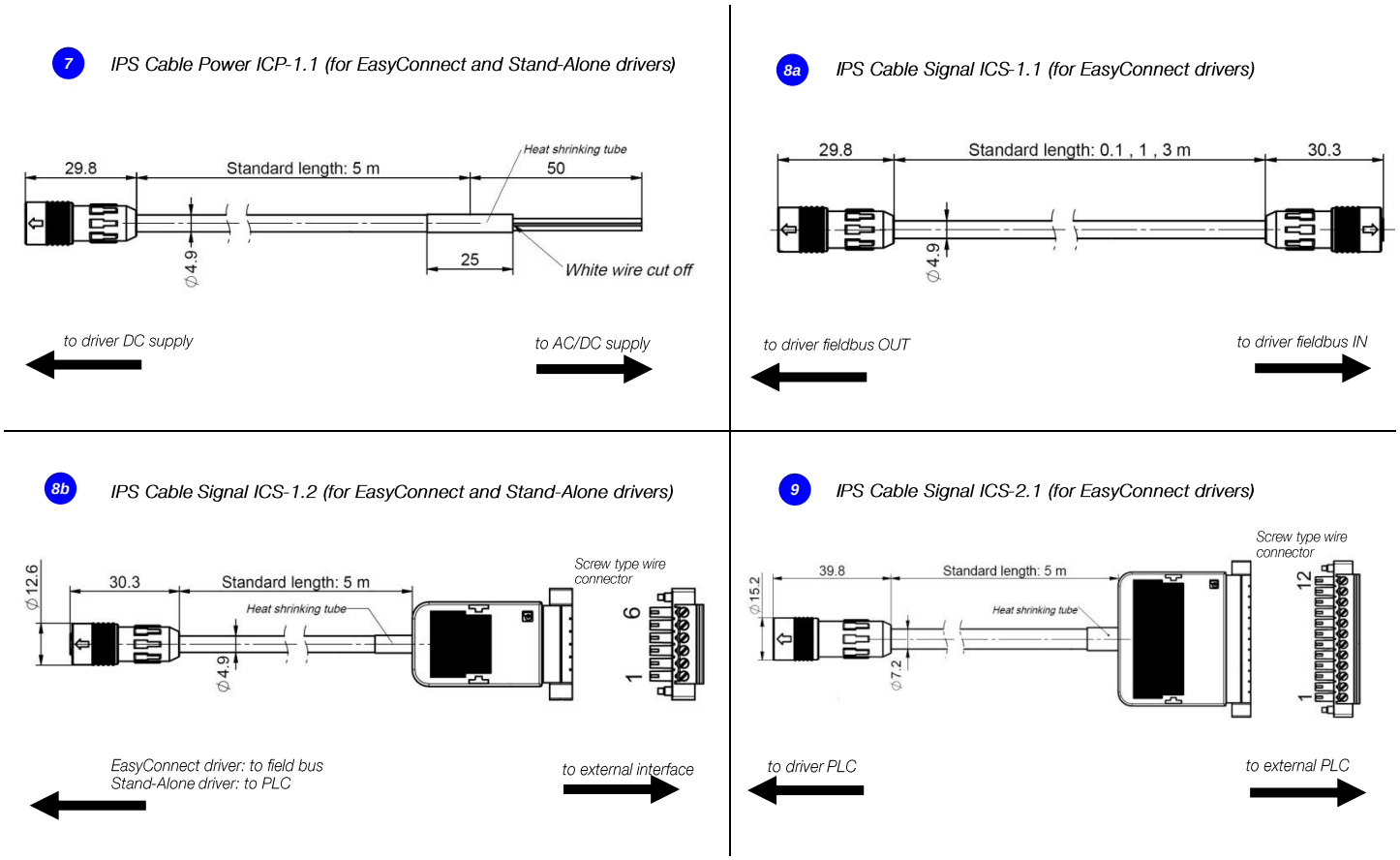


Figure 17: Basic dimensions and specifications of standard IPS cables

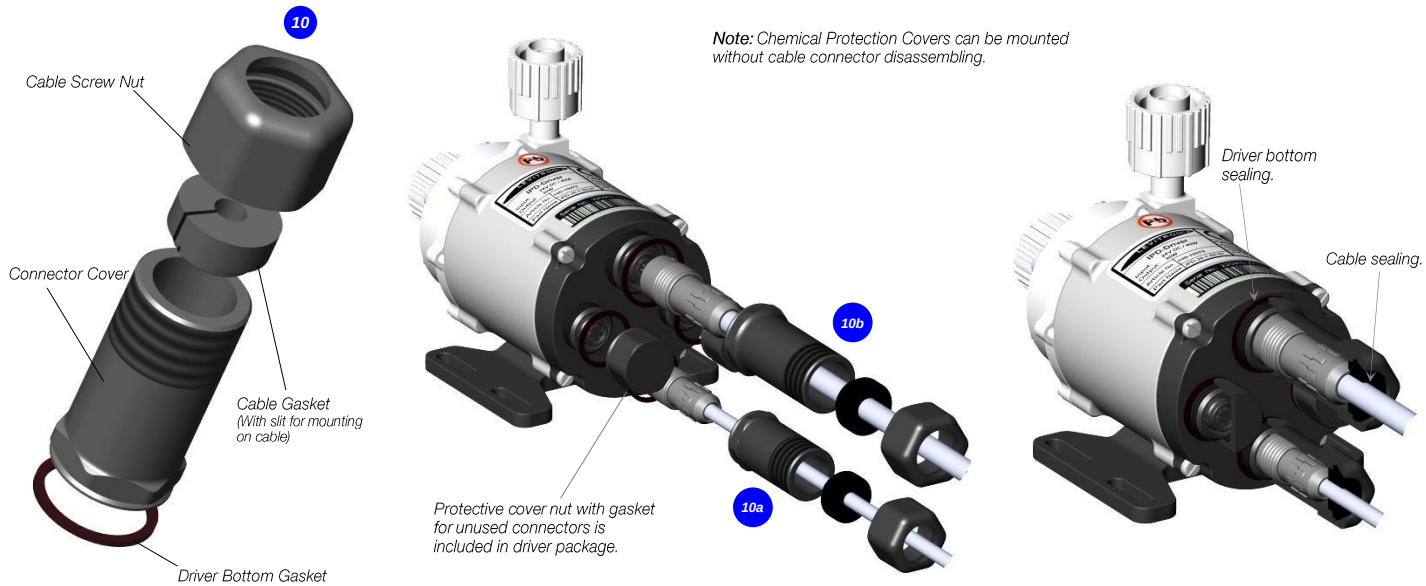


Figure 18: Basic concept of protective covers for enhanced chemical protection of driver connectors

ORDER INFORMATION

System Name	Article #	Pump Head	Driver	Note
BPS-i30.1	100-90831	LPP-30.1	IPD-30.1-50-01	*OEM - Epoxy coated driver, 5 m PVC cable with open wires, PTFE pump head.*
BPS-i30.2	100-90832	LPP-30.1	IPD-30.2-50-01	*OEM - ETFE coated driver, 5 m FEP cable with open wires, PTFE pump head.*
BPS-i30.3	100-91022	LPP-30.1	IPD-30.3-01 (MBP-i30.1 included)	*EasyConnect - Epoxy coated driver with interface connectors, PTFE pump head.*
BPS-i30.4	100-91023	LPP-30.1	IPD-30.4-01 (MBP-i30.1 included)	*EasyConnect - ETFE coated driver with interface connectors, PTFE pump head.*
BPS-i30.5	100-90987	LPP-30.1	IPD-30.5-01 (MBP-i30.1 included)	*Stand-Alone - Epoxy coated driver with integrated user panel, PTFE pump head.*

Table 1: Standard system configurations

Pos.	Component	Article Name	Article #	Characteristics	Value / Feature
1	Pump Head	LPP-30.1	100-90828	Impeller / Pump Housing Sealing O-Ring In-/Outlet Fittings Max. Flow Max. Diff.-Pressure Max. Viscosity Max. Liquid Temp.	*PTFE / PTFE* *Kalrez® perfluorelastomer [1]* *3/8" Pillar Super 300 FM (female)* *7.4 liters/min / 2 gallons/min* *1.5 bar / 22 psi* *10 cP* *70 °C / 158 °F*
2a 2b	Integrated Pump Driver ("OEM Models")	IPD-30.1-50-01 IPD-30.2-50-01	100-10075 100-10076	Voltage, Power Housing Cable Interfaces Standard Firmware	*24 VDC ±10%, 35 W* *Epoxy (a) or ETFE (b) coated Aluminum, PP for bottom lid, IP65* *PVC (a) or FEP (b) jacket, open wires, cable length 5 m* *PLC and RS485 with Modbus protocol (see Figure 15 for details)* *H1.48*
2c 2d	Integrated Pump Driver ("EasyConnect" Models)	IPD-30.3-01 IPD-30.4-01 (MBP-i30.1 included)	100-10095 100-10096	Housing Interfaces Standard Firmware	*Epoxy (c) or ETFE (d) coated Aluminum, PP for bottom lid, IP65* *2x Fieldbus RS485 with Modbus protocol, PLC and power supply* *H1.48 [3]*
2e	Integrated Pump Driver ("Stand-Alone" Model)	IPD-30.5-01 (MBP-i30.1 included)	100-10092	Housing Interfaces Standard Firmware	*Epoxy coated Aluminum, PP for bottom lid, IP65 [2]* *User panel with 3 user buttons, PLC and power supply* *H1.25*

Table 2: Specification of standard components

1: Kalrez® is a registered trademark of DuPont Dow Elastomers 2: Designed and tested for IP67. 3: Special firmware for serial pumping as one unit (Figure 9) available on request.

Pos.	Component	Article Name	Article #	Characteristics	Value / Feature
3	Impeller Exchange Kit	IEK-30.1	100-90837	Impeller LPI-30.1 (a) Sealing O-Ring (b) Pump Housing Screws (c) Pump Motor Screws (d) Exchange Tool IET-30.1 (e)	*PTFE* *O-Ring, Kalrez® 28.3 x 1.78 mm* *6 pieces, stainless steel PTFE coated, M5 x 14 mm* *4 pieces, stainless steel PTFE coated, M3 x 10 mm* *POM-C*
4	Mounting Base Plate	MBP-i30.1	190-10313	Material / Mounting Screws	*PP + 30% GF / 2 pieces, stainless steel FEP coated, M3 x 10 mm*
5a	AC/DC Power Supply	TPC 055-124 HR30 (Traco)	100-40014	Voltage Output / Input Basic Dimensions Certification or Standards	*24 VDC with 55 W / 85 – 264 VAC, 47-63 Hz* *45 x 90 x 96.5 mm (mountable on DIN rail 35 mm)* *UL, CSA, CB, Semi F47*
5b	Desktop AC/DC Power Supply	AC/DC Power Supply VEC50US24 HR30 (HR30 Connector)	100-40015	Voltage Output / Input Basic Dimensions Safety Approvals Note	*24VDC, 50W / 90 – 264 VAC, 47-63 Hz* *116 x 52 x 31 mm* *IEC60950-1, EN60950-1, UL/cUL60950-1* *Connector for direct connection to power supply of driver with cable length 1.2m.*
5c	AC Mains Cables (for Desktop power supply 5b)	AMC-1.1 (2m) AMC-1.2 (2.5m) AMC-1.3 (2.5m) AMC-1.4 (2.5m) AMC-1.5 (2.5m)	190-10331 190-10332 190-10333 190-10334 190-10335	Cable Specifications Approvals and Country Approvals and Country Approvals and Country Approvals and Country Approvals and Country	*Black color, ROHS* *UL, cUL, US, Canada* *CB, Germany, Denmark, Norway, Finland, Belgium, Netherland, Sweden, Austria* *PSE, Japan* *Switzerland* *CE, United Kingdom*
6	USB to RS485 Adaptor-TR Isolated	YN-485I-TR	100-30392	Structure/Design Purpose	*USB connector (6a) with termination resistor and cable with connector pair (6b and 6c) for external RS485 wire connection. Magnetically isolated. Cable length is 2m.* *Communication over fieldbus of driver with PC*

Table 3: Specification of general accessories

Pos.	Component	Article Name	Article #	Characteristics	Value / Feature
7	IPS Cable Power 3 Wires	ICP-1.1-50 (5 m)	190-10342	Cable Material / Wires Connection In / Connection Out Main Purpose	*PVC jacket / 3x 0.5 mm² (only 2 wires used, 1 is cut)* *Open wires / Circular Hirose type to driver* *Connection of power supply to "Stand-Alone" and "EasyConnect" drivers*
8a	IPS Cable Signal 6 Wires	ICS-1.1-01 (0.1 m) ICS-1.1-10 (1 m) ICS-1.1-30 (3 m)	190-10343 190-10344 190-10345	Cable Material / Wires Connection In / Connection Out Main Purpose	*PVC jacket / 6x 0.08 mm² and shielding* *Circular Hirose type / Circular Hirose type* *Fieldbus connection between "EasyConnect" drivers (e.g. multi-pump arrays)*
8b	IPS Cable Signal 6 Wires	ICS-1.2-50 (5 m)	190-10346	Cable Material / Wires Connection In / Connection Out Main Purpose	*PVC jacket / 6x 0.08 mm² and shielding* *Connector with screw type plug for open wire connection / Circular Hirose type* *Fieldbus connection to "EasyConnect" drivers and to PLC of "Stand-Alone" drivers.*
9	IPS Cable Signal 12 Wires	ICS-2.1-50 (5 m)	190-10347	Cable Material / Wires Connection In / Connection Out Main Purpose	*PVC jacket / 12x 0.14 mm² and shielding* *Connector with screw type plug for open wire connection / Circular Hirose type* *General connection to PLC of "EasyConnect" drivers.*
10a 10b 10c	Chemical Protection Connector Cover	CPC-1.1 CPC-1.2 CPC-1.5	190-10349 190-10350 190-10352	Materials, IP-Rating Main Purpose of *CPC-1.1* Main Purpose of *CPC-1.2* Main Purpose of *CPC-1.5*	*PP+GF30 and FPM/FKM for sealing gaskets, IP65 [1]* *Chemical protection of driver connectors of ICP-1.x and ICS-1.x cables.* *Chemical protection of driver connectors of ICS-2.x cables.* *Chemical protection of fieldbus termination connector FTC-1.1*
11	Fieldbus Termination Connector	FTC-1.1	190-10348	Materials Main Purpose	*PPS for connector housing and FPM for sealing.* *Termination of fieldbus.*

Table 4: Specification of cables and other accessories

1: Designed and tested for IP67.

Figure 19: Pump systems with standard components

Figure 20: General accessories

Figure 21: Cables and cable accessories

Levitronix® is the world-wide leader in magnetically levitated bearingless motor technology. *Levitronix®* was the first company to introduce bearingless motor technology to the Semiconductor, Medical and Life Science markets. The company is ISO 9001 certified. Production and quality control facilities are located in Switzerland. In addition, *Levitronix®* is committed to bring other highly innovative products like the *LEVIFLOW®* flowmeter series to the market.

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